SI1410 - HT 2016
Class analysis

Course data

Course Name	Basic Modeling in Biotechnology
Credits	6 hp
Time Period	HT 2016
Teachers	Lucie Delemotte, Annie Westerlund
Classroom hours	9 x 1.5h Lectures; 9 x 2h Computer Lab
Nr of registered students	36
Examination rate, in %	86.1%

Goals

Global course goals	• Create simple models for systems of relevance in biotechnology such as product formation in bacterial culture, metabolic processes in the cell and protein interaction. • Solve these models both analytically and numerically by primarily using course materials Matlab codes with own edits. • Visualize the solutions graphically. • Analyze and discuss the plausability of the results.
How the course design helps fulfill these goals	The class consists mainly of three activities, covering 9 different topics: • Students are told to read the book chapter corresponding before the lecture • The lecture covers a specific topic, lecture slides are made available before the lecture, lecture notes are made available after the lecture. The mathematical derivations are done on the blackboard. Solution to exercises are covered during the lectures. • Students attend computer labs corresponding to the subject matter of the lecture, they have to show and discuss their answers to all the questions in class or by email in order to pass. The class is divided into 2 groups. The students work in pairs, unless they choose to work alone. The pairs are attributed at random. The lab text was published a few hours before the first groups scheduled lab time. • The evaluation consists of two parts: two lab reports are graded as P/F and a final written exam determines the A-F grade.

Pedagogical development - I

Changes made since previous time course given	N/A, first time course

Course evaluation; comments from students

Evaluation response rate	39,0%
Overall student view	It is a stimulating class where students work with interesting problems, which makes learning the maths more meaningful. However, it is a too challenging class for which they are not well prepared. The class needs to be more structured. The class climate is collegial and supportive. Due to a too short exam time, the examination did not allow the students to show the extent of their knowledge and as result the grades felt arbitrary. They would like to understand better what they need to do to obtain a certain grade.
Positive comments	• “Even though this was a challenging course I think it was one of the most interesting and useful courses I have taken at KTH. I have learnt a lot about differential equations and different modeling (e.g. discrete) that can be useful when it comes to analyzing and interpreting of biological phenomena.” • ‘‘The lab course was really good! I have learnt loads about Matlab and we were able to practice our own ideas, which was great! We also covered some really interesting topics in the course and it was really cool to be able to make mathematical models of real life events. This felt extra useful when we discussed topics relevant to our education, such as medicine and cancer.” • ‘‘Making math a bit more interesting with the biological aspect.”
Negative comments	• “The other part of the course, the theoretical and solving problems parts, really needs to be more thorough. All my time spent went to solve the programming assignment, where my background knowledge was not sufficient. This made the other parts second priority, thus I did not have enough time to go through course literature and the lecture slides.” • “Since we have little knowledge of the maths behind some parts of the course, it would've been great to go through the maths more thoroughly.” • “Another thing is the time of the exam. I think that the biggest reason it did not go as well as it could was the lack of time and the stress. One hour more would have meant a lot for the results.”
Pre-knowlegde, comments	• “Sure, I understand that it is good to understand how it is derived but much of the math we haven't had in a previous courses yet.” • “Would've been good with multiple variable analysis and differential eq.” • “All my time spent went to solve the programming assignment, where my background knowledge was not sufficient.”

Course design, comments	• “Lectures more focused on specific parts, now they felt all over the place. Since we have little knowledge of the maths behind some parts of the course, it would've been great to go through the maths more thoroughly. More examples on the board! It was very difficult to follow the powerpoint presentation” • To improve: “The course outline and what was crucial to understand during the course.” • “It would also have been nice to have some more practice questions, but since this was a completely new course I understand that it was difficult to make” • “More exercise sessions would have increased my understanding of the models.” • “Why was the second lab group given one/two/three days more than the first lab group? I found this to be very unfair as the second lab group basically could do the whole lab in advance and come prepared with questions on the more difficult parts, while the first lab group had ONE evening to prepare. I hope you will consider this “ • “I also strongly suggest that the teams are made on your own. My reports was made by me and only me which made the other too lazy people pass without doing anything.”
Literature, comments	• “I don't know if the intended course literature was good enough. Much of it was just things we might have already encountered in other courses but it really did not help us to solve problems.”
Examination, comments	• “I think the exam was difficult not only because it was short time, but because there were lots of text that made it distracting and there were far many questions. I would prefer that it is 3 hours and kind of easier that 5 hours and that extensive.” • “The course was good overall, although I'm very disappointed with the exam. I didn't feel like I could perform my very best because of the stress /panic that was caused due to the short time frame.” • "Good exam-questions, they did ask the right things. It is just sad that we did not have more time as it made us stress and make mistakes that we would not have otherwise.”
Particularly interesting comments	• "When studying for the exam, I redid all the computer labs and I understood so much more of the questions after having understood the theory behind it.” • “The course becomes more fun, interesting and useful if you study a lot on your own.” • “The best topics were the ones that felt related to our education, such as drug distribution in the body and genetics. It would've been fun to see some models related to environmental problems or industrial biotechnology as well. It was also fun to create your own models”
Course teacher’s impressions from the evaluation	The student’s comments are fair for the most part and in line with the oral feedback gotten throughout the class and during the FX to E completion oral exam. There are useful comments that will be used to make changes for the next edition of the class.

Course teacher’s summary

Overall view	It was easy to convince the students that the subject matter is important. When in class and in the labs, the students were generally engaged and the atmosphere was pleasant. However, the background level of the students in math in particular is extremely weak which slows down the rhythm of the class a lot. At first it was difficult to motivate the students to work outside of the class. Since this was the first edition of the class, the structure was not optimal and there was just not enough class material to give the students enough practice problems/homework to prepare them for the exam. Finally the final exam was much too ambitious and thus the results were disappointing of everyone involved.
Positive comments	• The students immediately liked the idea of modeling biological systems and were interested in the subject matter. • The students were a pleasant group, they worked well together and with the teachers, without unhealthily competing and generally supporting the weaker students. • They were constructive in giving feedback. • As time went by, they realized the difficulty of the class and started putting in the efforts needed. It was very rewarding seeing them the last labs and at the revision session with good questions. Even if the exam was stressful, a large part of the students made a lot of progress, especially in the graphical interpretation of the results.
Negative comments	• A first edition of the class is always difficult but this was extra challenging to prepare because not good literature exists at that level (Books on non-linear dynamics are generally too advanced, books on modeling in biology are generally at the advanced level and the Herod book covers the modeling/ programming part but not the math behind it). As a result all the material had to be created (lecture notes, appropriate practice problems and exam) and I wasn't able to have enough for this first edition of the class. • The class is too ambitious, because of the simultaneous presence of a "math" and a programming "component", for which the students don't have the background knowledge. To add difficulty, the heterogeneity of the student's knowledge and ability is very diverse, with some people been naturally good at scripting while others struggle enormously. • Because of this, the "lab" component required too much time from some of the students who were unable to then focus on the rest of the class. • The class outline had to be adjusted along the class to adapt to the general level, which caused major problems in the structure and lost some of the students. • In the initial class design, 9 lectures were scheduled and 9 labs. The intention was to do exercises during the lecture time. But as this was not enough because the pace of the lectures had to be slowed down a lot, I attempted at correcting this by adding 3 non-compulsory exercise sessions. About 1/3 of the students showed up. Having those scheduled from the beginning would probably have yielded a higher turnout and more success at the exam. • The final exam was a major disappointment to the students. The number of questions was too long for the 3 hours time allocated and many of them panicked. As a result the grading criteria had to be adjusted. This was difficult to do in a fair way and I can understand why the students did not expect the grade they thought they would. This is the major point to solve for tenet time's edition.

View on pre-knowlegde	The students in this program have less math classes and presumably do not use this knowledge in other classes. As a result, they forget what they have learned from one year to the other and when they come to this class a lot of students don't even remember what they have learned. Their background in calculus and linear algebra is not sufficient for the the class in the present format. In terms of programming, they have had one class previously that uses matlab but it is maybe the first time where they write whole programs. This requires major efforts from a lot of them. The major difficulty here is the heterogeneity in the students skills and abilities (as is apparently the case in math-oriented classes) such that it is hard to cater to all the students in the class.
View on course design	• I wanted to base the class on examples of problems that can be modeled (population dynamics, HIV, population genetics…) and let the pattern in terms of the type of models that can be used emerge. Given the overall difficulty of the class, this was next to impossible for 90% of the students. In the next edition, we will have a more structured course where the different blocks are centers around the types of models. • We will also add more homework and exercise sessions to help the students study continuously. • The random group assignment for the labs in this edition was messy and needs to be more structured. Right now, the randomization did not work properly since the students wanted to start working with the problems before the lab sessions (also due to the labs being quite extensive), and then splitting the already formed groups was somewhat counterproductive
View on course material	• It is difficult to find a good course book: books on dynamics are generally too advanced, books on modeling in biology are generally at the advanced level and the Herod book covers the modeling/programming part but not the mathematical basis. • As a first edition of the class the course material had to be created from scratch and there was simply not enough (no practice exam for example). The next edition should be easier.
View on examination	• The two graded labs were successful although their timing could have been better. The second lab had to be handed in one week before the final exam. • The final exam was a major disappointment: the text was too long for the 3 hour exam. The students appreciated the exam questions, especially when they studied it after the exam time, they realized how easy and appropriate is was. However, due to the stress of the exam they were not able to perform their best. • Because large sections of the exam had not been covered (and different sections for different students), we had to adjust the grading criteria a posteriori. This means a lot of the students received a grade they were not expected. I understand why this feels unfair. Fortunately, this can be corrected easily for the next edition of the class.

Pedagogical development - II

Outcome of course change made since last time course was given	N/A
Changes to be made before next time course is given	• The structure of the class will change: instead of having 9 blocks, each covering a biological question and how to model it, we will have 6 blocks, more centered around a mathematical concept (each of which is a threshold concept that allows to move on to the next block). Each block will not only have a lecture and a lab but also an exercise session to solve homework problems. • Several chapters of the Strogatz "*Non-linear dynamics and chaos*" book will be added as required reading. • We will let the students choose their groups for lab work. • The labs will be published at the beginning of the week such that the first lab group also has time to prepare the lab. • We will use peer-review of the graded labs such that the students have a more global understanding of what their peers are achieving. • We will use this year's exam text as preparation for next year. • The final exam will have a shorter text and will be 5 hours long. We will clarify before hand grading criteria. Instead of being point based, we will adopt a holistic view and mark each individual problem from A to F. All the problems will need to be passed in order to pass the exam and the final grade will be based on the grade of the individual problems. • Finally, to solve the background knowledge problem, I hope we can have a program-wide discussion to maybe either such the math classes closer together or find a way to have the students use more of their knowledge of math applied in other courses.

Other

Comments	